1
Ag84Mr

MRR1064

MRR 1064

...tly revised
...rint
...ersedes
...ceived 2/4/77

INFLUENCE OF GIN AND LINT CLEANER COMBINATIONS AND MILL CLEANING ON DUST LEVELS AND YARN QUALITY OF ACALA COTTON

Marketing Research Report No. 1064

Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

CONTENTS

TABLES

Washington, D.C. Issued February 1977

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

INFLUENCE OF GIN AND LINT CLEANER COMBINATIONS AND MILL CLEANING ON DUST LEVELS AND YARN QUALITY OF ACALA COTTON

By Joseph B. Cocke, Charles K. Bragg, and Ivan W. Kirk[1]

ABSTRACT

Machine-picked 'Acala 1517–V' cotton was subjected to four gin and lint cleaner combinations and two mill-cleaning levels to determine the effect of such treatments on card-room dust levels and on fiber and yarn quality. The data presented will indicate to ginners and textile mill operators those processing treatments that will contribute to lower dust levels without undue adverse effect on fiber and yarn quality. **KEYWORDS: cotton, cotton dust, cotton ginning, fiber quality, lint-cotton cleaning, mill cleaning (cotton), spinning performance, yarn quality.**

INTRODUCTION

The effect of dust in raw cotton on air quality in the mill is of vital concern to the spinner. The recent introduction of standards by the Occupational Safety and Health Administration (OSHA), limiting employee exposure to raw-cotton dust in the textile mill, has focused attention on the problem. Maintaining mill dust levels within the present OSHA standard of 1 milligram per cubic meter for an 8-hour time-weighted average could have an adverse effect on the competitive position of cotton in the fiber market. The costs involved in maintaining dust levels at a proposed lower level would jeopardize the position of cotton even more so.

Mill-processing conditions and the dust-generation potential of cotton are the two major factors affecting mill dust levels. Mill-processing conditions are determined by administrative and engineering decisions that may range from a simple solution, such as changing the speed of a processing machine, to the installation of an elaborate dust-collection system requiring a considerable capital expenditure. On the other hand, the dust-generation potential of the cotton is determined prior to its being delivered to the mill.

Dust levels appear to be influenced by the trash content in lint, increasing as the trash content increases. Cultural, harvesting, and ginning practices and varietal characteristics affect trash levels and, therefore, dust levels to varying degrees. The dust level in cotton can be reduced significantly by using lint cleaners at the gin.[2] The competitive position of cotton could be enhanced by determining the optimum combination of gin conditioning and cleaning machinery for processing cotton harvested by different methods and containing different quantities of moisture and trash in order to obtain a bale with a minimum amount of dust. Lowered dust potential in the bale would help

[1] Agricultural engineer and textile technologist, Cotton Quality Research Station, Agricultural Research Service, Clemson, S.C. 29631; and agricultural engineer, Southwest Cotton Ginning Research Laboratory, Agricultural Research Service, Mesilla Park, N. Mex. 88047.

[2] Cocke, Joseph B., and Hatcher, John D. 1975. Dust levels in experimental card room as influenced by cotton variety and by harvesting and ginning methods. Trans. ASAE 18(6): 1006–1010.

the textile mill maintain dust levels within OSHA standards. However, gin-processing systems designed to reduce dust levels must not seriously affect fiber and yarn quality. Otherwise, the benefits of reduced dust levels will be offset by a reduction in yarn quality and spinning performance.

The objective of this study was to determine the effect of gin and lint cleaner combinations and mill-cleaning levels on card-room dust levels and on fiber and yarn quality of Acala cotton.

METHODS AND MATERIALS

Production and Harvesting

Test cotton was 'Acala 1517–V' variety grown by a private producer near Las Cruces, N. Mex., according to cultural and harvesting practices recommended for the area. Herbicides were applied at preplant and at layby. No harvest-aid chemicals were applied. The cotton was first-harvest machine-picked after frost on November 24, 1974. Three pickers were used, all dumping into the same trailers. One of the pickers used a spindle wetting agent in water; the other two pickers used only water for spindle moistening.

Ginning

The cotton was ginned at the Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex., November 25–27, 1974. Four gin and lint cleaner combinations were used as the gin variable: (1) a saw gin and two saw-type lint cleaners, (2) a saw gin and one saw-type lint cleaner, (3) a roller gin and two mill-type lint cleaners, (4) a roller gin and one saw-type lint cleaner.

Bale-size lots were used for each treatment, and each treatment was replicated two times for a total of eight ginning lots. Treatments were randomized within replications.

The seed-cotton-cleaning treatment was constant for all lots and consisted of a drier (150° F), a six-cylinder cleaner, a stick machine, a stick machine, a six-cylinder cleaner, and an extractor-feeder. The feeder over the saw gin had more cleaning capability than the feeder over the roller gin.

The saw gin was a large-diameter-saw, high-capacity gin. The saw-type lint cleaners in the saw gin were conventional controlled-batt lint cleaners. The roller gin was a rotary knife high-capacity gin. The mill-type cleaners were each composed of an Aldrich beater and a pneumatic lint cleaner. The saw-type lint cleaner in the roller gin had a modified feed plate.

The seed-cotton-processing rate for all treatments was uniform at 5.3 bales per hour, but the processing times through the two gins were different because of the difference in ginning capacity.

Samples were extracted during processing for moisture and trash analysis of seed cotton, seed, and lint; color analysis of lint; lint-classification data; and analysis of fiber properties.

Mill Processing

Mill processing was performed at the USDA Cotton Quality Research Station, Clemson University, Clemson, S.C. Two cleaning levels were used. One-half of each 500-pound bale was processed through the entire opening-picking line and formed into laps. The opening line consists of three blender-feeders, a vertical opener, a No. 12 lattice opener, and a two-section one-process picker. The other one-half of each bale went directly from the blender-feeder to the picker, bypassing the vertical and lattice openers. Each one-half bale produced about six laps. The two cleaning levels are referred to as maximum and minimum.

The four gin and lint cleaner combinations and the two mill-cleaning levels were replicated 2 times for a total of 16 mill-processing lots. The gin and lint cleaner combinations were randomized within replications, but those lots that received maximum mill cleaning always preceded those lots that received minimum cleaning.

The following processing organization was used to spin 60s combed yarn:

Picker	14-ounce lap.
Card	55-grain sliver, 16 pounds/hour.
Breaker drawing	8 ends up, 42-grain sliver.
Lap winder	20 ends up, 806-grain lap.
Comber	53-grain sliver, 14 percent noils.
Finisher drawing	8 ends up, 55-grain sliver.
Roving	1.50 hank, 1.20 twist multiplier.
Spinning	60s yarn, 3.10 twist multiplier, 13,000-r/min spindle speed.

Testing

Dust sampling

Each test lot was processed through the controlled experimental card room.[3] Test conditions were: temperature, 75° F; relative humidity, 55 percent; airflow rate, 550 cubic feet per minute; changes of room air, 11.5 per hour; and card production rate, 16 pounds per hour. No continuous cleaning equipment was used on the card.

Dust samples were obtained simultaneously at four locations with a personal sampler and at two locations with a vertical elutriator sampler during the test period. A total of 5 dust samples were obtained at each personal-sampler location and 10 samples at each elutriator-sampler location. Sampling time for the elutriator sampler was one-half that of the personal sampler.

Fiber testing

Fibrograph measurements, Pressley 0-inch gage and ⅛-inch gage (grams per tex), and micronaire fineness were made on four subsamples of ginned lint from each bale, and one sample of finisher drawing sliver from each lot. Array tests were made on a composite sample from the four subsamples and finisher drawing sliver. The resulting measurements can be summed up as follows:

Instrument	Measurements per sample	Number of samples	Total measurements per bale or lot
Automatic-sampler			
fibrograph	4	4	16
Array	2	1	2
Pressley:			
0-in gage	4	4	16
⅛-in gage	4	4	16
Micronaire	2	4	8

Color measurements were made on ginned-lint samples before and after Shirley analyzer tests.

Official classification data were obtained from the Board of Supervisory Cotton Examiners, Memphis, Tenn.

[3] Cocke, Joseph B., Hatcher, John D., and Smith, D. L. 1975. Experimental card room for studying dust generation by cotton. Am. Text. Rep./Bull. AT-4(5): 16–21.

Yarn evaluation

For each spinning test, 10 bobbins of yarn from each of the 4 spinning frames (40 bobbins) were tested for skein strength and yarn size.

Sixteen bobbins were tested for yarn evenness and imperfections. The sensitivity of the evenness tester was set at 30 percent for thin places and at setting number 4 for thick places and neps. Yarn from each bobbin was tested at 25 yards per minute for 5 minutes (2,000 yards/lot). Imperfections are reported per thousand yards.

Single-strand-strength tests were made on 40 bobbins, 10 breaks per bobbin.

Yarn grade was determined from three yarn boards per spinning test by three technicians.

Other sampling

Waste removed at opening, picking, and carding was collected and weighed. Lint samples were obtained from the blender-feeders and from the picker lap to determine the trash content.

Statistical analysis

Variables for the ginning phase were the four gin and lint cleaning combinations with two replications. An analysis of variance (randomized complete-block design) was used to determine differences in test items among the four treatment combinations.

Variables for the mill-processing phase were the four gin and lint cleaning combinations and two mill-cleaning levels with two replications. Comparisons for the two test variables and test items were made through an analysis of variance for a split-plot design. The main plot factor was the gin and lint cleaning combination and subplots were the two mill-cleaning levels.

RESULTS AND DISCUSSION

Ginning and Fiber Quality

Wagon samples of seed cotton were relatively uniform in trash content and moisture content for all experimental units (tables 1 and 2). The trash content at the feeder apron of test lots for the roller-gin treatments was higher than that at the feeder apron of the saw-gin treatments. This was probably because of the greater cleaning capability of the feeder over the saw gin, since the remainder of the seed-

TABLE 1.—*Means for gin-processing performance measurements by gin type and lint-cleaning level*

Measurement	Saw gin and lint cleaner: 2 saw cleaners	Saw gin and lint cleaner: 1 saw cleaner	Roller gin and lint cleaner: 2 mill cleaners	Roller gin and lint cleaner: 1 saw cleaner	Significance level[1]
Fractionation:					
Wagon, total trash ....percent....	5.49	5.61	5.94	6.04	NS
Feeder, total trash ....do.......	1.76c	1.60c	2.68a	2.24b	0.01
Moisture:					
Wagon, seed cotton ....do.......	6.4	6.9	6.1	6.6	NS
Feeder, seed cotton ....do.......	5.7	5.7	5.7	5.7	NS
Lint, after first lint cleaner ....do.......	3.5	3.4	3.2	2.2	NS
Processing rate:					
Seed-cotton cleaning ....lb/min....	130	133	132	133	NS
Ginning ....min/bale/gin stand[2]....	15.4b	14.4b	95.5a	92.4a	0.01
Trash collection:					
Seed-cotton system ......lb/100 lb seed cotton....	4.91	5.65	4.64	4.96	NS
Lint system ....lb/100 lb ginned lint....	7.22a	5.77b	3.91c	3.74c	0.01
Trash-system efficiency:					
Seed-cotton system ....percent....	67.3	73.0	55.5	63.2	NS
Lint system ....do.......	70.4a	63.4a	56.9ab	43.9b	0.01

[1] Duncan's 5% multiple-range significance designations are shown when the significance level is less than 5%. NS=not significant.

[2] 90-saw saw gin; 40-inch roller gin.

TABLE 2.—*Additional means for gin-processing performance measurements by gin type and lint-cleaning level*

[Percent]

Measurement	Saw gin[1] and lint cleaner: 2 saw cleaners	Saw gin[1] and lint cleaner: 1 saw cleaner	Roller gin[2] and lint cleaner: 2 mill cleaners	Roller gin[2] and lint cleaner: 1 saw cleaner	Significance level[3]
Wagon fractionation:					
Hulls	1.66	1.68	1.84	1.74	NS
Sticks	.67a	.46b	.46b	.50b	0.05
Motes and fine	3.16	3.47	3.64	3.80	NS
Total trash	5.49	5.61	5.94	6.04	NS
Feeder fractionation:					
Hulls	.28	.16	.68	.40	NS
Sticks	.14	.10	.20	.26	NS
Motes and fine	1.34	1.34	1.80	1.58	NS
Total trash	1.76c	1.60c	2.68a	2.24b	0.01
Lint turnout	34.0	34.4	35.8	35.4	NS
Seed properties:					
Trash content	.4b	.5b	2.7a	2.8a	0.05
Moisture	7.5	7.5	7.3	7.4	NS
Damage	7.2	6.2	5.8	8.2	NS

[1] 90-saw saw gin.

[2] 40-inch roller gin.

[3] Duncan's 5% multiple-range significance designations are shown when the significance level is less than 5%. NS=not significant.

cotton-cleaning system was uniform for all treatments, and there were no differences in initial seed-cotton-trash levels and seed-cotton-processing rates.

Ginning rates for the two gins were different, as expected, averaging four bales per hour for the saw gin and three-fourths of a bale per hour for the roller gin.

The quantity of trash removed by the lint-cleaning system was higher for the saw-ginned treatments than for the roller-ginned treatments. Two saw-type lint cleaners removed more trash and had a higher cleaning efficiency than the other treatments. The saw gin and one saw-type cleaner had a higher lint-cleaning efficiency than the roller gin and one saw-type lint cleaner. This difference was expected because of the modification on the saw-type lint cleaner used with the roller gin. Lint-cleaning efficiency for roller-ginned cottons, although not significantly different, trended higher for the two mill-type lint cleaners than for the one saw-type cleaner.

Lint turnout percentages were not significantly different for the two types of gins but trended higher for the roller-ginned treatments.

Color, leaf, and composite grade indices for the combination of a saw gin and two saw lint cleaners were significantly higher than those of the other three combinations (table 3). Reflectance (R_d) of the saw gin and two saw lint cleaner combination and degree of yellowness ($+b$) of the roller gin and two mill lint cleaner combinations were higher than each of the other three treatment combinations.

Classer's staple length and micronaire were not affected by the gin and lint cleaner combination.

The higher cleaning efficiency and the greater amount of trash removed by the saw gin and two saw lint cleaner combination were reflected in the significantly lower amount of waste in the lint from this treatment than that of the other combinations.

After lint was processed through the Shirley analyzer, reflectance (R_d) levels of the saw-ginned treatments were higher than those of the roller-ginned treatments, and degree of yellowness ($+b$) of the saw gin and one saw lint cleaner combination was lower than that of all other combinations. Reflectance and degree of yellowness of lint processed through the Shirley analyzer were higher than in the ginned lint.

Digital fibrograph results for ginned lint samples showed that 2.5-percent span length, 50-percent span length, and uniformity ratio of roller-ginned cottons were greater than in the saw-ginned cottons (table 4). The 2.5-percent span length for the roller gin and two mill lint cleaner combination was greater than that of all other combinations.

TABLE 3.—*Effect of gin and lint cleaner combination on grade, staple, and color quality of ginned lint*

Measurement	Saw gin[1] and lint cleaner		Roller gin[2] and lint cleaner		Significance level[3]
	2 saw cleaners	1 saw cleaner	2 mill cleaners	1 saw cleaner	
Ginned lint:					
Color grade index[4]	100a	94b	94b	94b	0.01
Leaf grade index[4]	94a	85b	85b	85b	0.01
Composite grade index[4]	94a	85b	85b	85b	0.01
Staple ....32d's in.	37	37	37	37	NS
Reflectance ....R_d	78.7a	76.6b	75.9b	75.7b	0.01
Yellowness ....$+b$	6.75a	6.60a	6.90b	6.65a	0.05
Micronaire reading	3.8	3.8	3.8	3.7	NS
Total Shirley analyzer waste ....percent	2.05b	3.35a	3.00a	3.20a	0.01
Lint process through Shirley analyzer:					
Reflectance ....R_d	79.7a	79.5a	78.2b	78.1b	0.01
Yellowness ....$+b$	7.35a	7.15b	7.40a	7.45a	0.01

[1] 90-saw saw gin.
[2] 40-inch roller gin.
[3] Means in a row not followed by a common letter differ at the level of significance shown. NS=not significant.
[4] Middling White (31) = 100.

Pressley strength, ⅛-inch gage, for the roller gin and one saw lint cleaner combination was greater than that of all other treatment combinations.

Array data showed that upper-quartile length for the roller gin and two mill lint cleaner combination was longer than that of all other combinations, and that the mean length for the roller gin and two mill lint cleaner combination was greater than that of both saw-gin treatments. Roller-ginned cottons had a higher percentage of fibers greater than 1 inch, when

TABLE 4.—*Effect of gin and lint cleaner combination on length, strength, and length distribution of fiber*

Measurement	Saw gin[1] and lint cleaner		Roller gin[2] and lint cleaner		Significance level[3]
	2 saw cleaners	1 saw cleaner	2 mill cleaners	1 saw cleaner	
Digital fibrograph:					
2.5-percent span length ....in....	1.17c	1.17c	1.21a	1.19b	0.01
50-percent span length ....in....	0.50b	0.50b	0.54a	0.53a	0.01
50/2.5 uniformity ratio ....percent....	43b	43b	45a	45a	0.01
Pressley strength:					
0-inch gage ....1,000 lb/in²....	91	91	89	92	NS
⅛-inch gage ....g/tex....	27.1b	27.5b	27.2b	28.7a	0.01
Suter-Webb array:					
Upper-quartile length ....in....	1.30b	1.30b	1.33a	1.30b	0.01
Mean length ....in....	1.07b	1.07b	1.12a	1.09ab	0.01
Coefficient of variabiilty ....percent....	29bc	30c	28.5ab	28a	0.01
Fibers less than ½ inch ....do.......	7a	7a	7.5ab	8b	0.01
Fibers ½ inch to 1 inch ....do.......	24.8b	25.8b	16.8a	19.3a	0.01
Fibers greater than 1 inch ....do.......	67.6b	66.4b	75.5a	72.5a	0.01

[1] 90-saw saw gin

[2] 40-inch roller gin

[3] Means in a row not followed by a common letter differ at the level of significance shown. NS=not significant.

TABLE 5.—*Effect of gin and lint cleaner combination and mill cleaning on processing waste and neps in card web*

Test variable	Waste (%)		Neps in card web (No./100 in²)
	Opening and picking	Card	
Gin and lint cleaner combination:[1]			
Saw gin and 2 saw lint cleaners	0.48	2.11c	9a
Saw gin and 1 saw lint cleaner	.75	2.73a	8ab
Roller gin and 2 mill lint cleaners	.67	2.47b	7b
Roller gin and 1 saw lint cleaner	.90	2.53b	7b
Mill-cleaning level:[1]			
Maximum[2]	1.05a	2.32b	7
Minimum[3]	.36b	2.60a	8
Average	.70	2.46	7.6

[1] Means not followed by a common letter differ at a 1% level of significance.

[2] Cotton processed through the entire opening-picking line: 3 blender-feeders, a vertical opener, a No. 12 lattice opener, and a 2-section 1-process picker.

[3] Cotton bypassed the vertical and lattice openers, going directly from the blender-feeder to the picker.

compared with the saw-ginned cottons, but for fibers from one-half inch to 1 inch, the saw-ginned cottons had a higher percentage.

Mill Preparation

Opening and picking waste was not affected by gin and lint cleaner combination. However, waste levels trended higher for the roller-ginned treatments and for those treatments that included only one saw-type lint cleaner (table 5). As expected, maximum mill cleaning removed a significantly greater amount of waste than the minimum mill-cleaning level, since all cleaning at the minimum level was restricted to the picker.

Card waste for the saw gin and two saw lint cleaner treatment was less than that of all other treatments, and both roller-ginned treatments were less than the saw gin and one saw lint cleaner treatment. Card waste for the maximum mill-cleaning level was significantly lower than that of the minimum mill-cleaning level.

Neps in the card web of both roller-ginned treatments were less than that of the saw gin and two saw lint cleaner treatment, but mill-cleaning level had no effect on neps in the card web.

Card-Room Dust Levels

Cottons that were saw-ginned produced lower dust levels in the experimental card room than did cottons that were roller-ginned (table 6). Dust levels measured by the personal sampler showed that the use of two saw-type lint cleaners reduced dust levels over that of one saw-type lint cleaner, and that the use of two mill-type lint cleaners with the roller gin was more effective than using one saw-type lint cleaner with the roller gin.

Dust levels measured by the vertical elutriator sampler indicated that lint-cleaning level did not affect dust levels of saw-ginned cottons, but, again, that the use of two mill-type lint cleaners with the roller gin was more effective than the use of one saw-type lint cleaner with the roller gin.

Extreme gin and lint cleaner treatment means indicated a decrease in dust level of approximately 24 percent when measured by the personal sampler and 19 percent when measured by the elutriator sampler.

TABLE 6.—*Effect of gin and lint cleaner combination and mill cleaning on card-room dust levels*

[Milligrams per cubic meter]

Test variable	Dust levels for— Personal sampler	Vertical elutriator sampler
Gin and lint cleaner combination:[1]		
Saw gin and 2 saw lint cleaners	4.29a	3.71a
Saw gin and 1 saw lint cleaner	4.69b	3.89ab
Roller gin and 2 mill lint cleaners	5.10c	4.13b
Roller gin and 1 saw lint cleaner	5.61d	4.57c
Mill-cleaning level:[1 2]		
Maximum	4.39a	3.69a
Minimum	5.45b	4.47b
Average	4.92	4.08

[1] Means not followed by a common letter differ at a 1% level of significance.

[2] For explanation of maximum and minimum, see table 5, notes 2 and 3.

Increasing the level of mill cleaning reduced dust levels in the card room significantly when measured by both the personal and elutriator samplers. Reductions were about 19 percent as measured by the personal sampler and about 17 percent as measured by the elutriator sampler.

Dust levels determined by the elutriator sampler were about 83 percent of that determined by the personal sampler.

The saw gin and two saw lint cleaner combination with maximum mill cleaning produced the lowest card-room dust levels as determined by both the personal and elutriator samplers (table 7). The highest card-room dust levels were produced by the roller gin and one saw lint cleaner treatment with minimum mill cleaning. The increase in card-room dust levels as a result of these treatment differences was about 61 percent when determined by the personal sampler and about 46 percent when determined by the elutriator sampler.

Simple correlation coefficients for dust levels and selected measures of evaluation show highest correlation with quantity of card waste (table 8). All measures of evaluation, except

(*Continued on page 10.*)

TABLE 7.—*Average card-room dust levels for treatment combinations*
[Milligrams per cubic meter]

Gin and lint cleaner combination	Maximum mill cleaning		Minimum mill cleaning	
	Personal sampler	Vertical elutriator sampler	Personal sampler	Vertical elutriator sampler
Saw gin and 2 saw lint cleaners	3.88	3.44	4.71	3.98
Saw gin and 1 saw lint cleaner	4.14	3.39	5.24	4.40
Roller gin and 2 mill lint cleaners	4.58	3.78	5.61	4.48
Roller gin and 1 saw lint cleaner	4.97	4.13	6.24	5.01

TABLE 8.—*Simple correlation coefficients for dust levels obtained by two samplers and selected measures of evaluation*

Dust sampler	Ginned lint			Picker waste	Card waste
	Leaf grade	Composite grade	Shirley analyzer total waste		
Personal:					
r	−0.49	−0.49	0.46	−0.39	0.62
Significance probability	.0497	.0497	.0807	.1375	.0096
Vertical elutriator:					
r	−.40	−.40	.33	−.46	.55
Significance probability	.1208	.1208	.2105	.0722	.0268

TABLE 9.—*Effect of gin and lint cleaner combination and mill cleaning on length and strength properties of finisher drawing sliver*

Test variable	Digital fibrograph			Pressley strength	
	2.5% span length (in)	50% span length (in)	50/2.5 uniformity ratio (%)	0-in gage (1,000 lb/in²)	⅛-in gage (g/tex)
Gin and lint cleaner combination:					
Saw gin and 2 saw lint cleaners	1.24	0.64	51	88	26.5
Saw gin and 1 saw lint cleaner	1.25	.65	52	87	26.5
Roller gin and 2 mill lint cleaners	1.26	.65	52	88	26.2
Roller gin and 1 saw lint cleaner	1.25	.65	52	89	26.5
Mill-cleaning level:[1]					
Maximum	1.25	.64	52	88	26.4
Minimum	1.25	.65	52	([2])	([2])
Average	1.25	.64	52	88	26.4

[1] For explanation of maximum and minimum, see table 5, notes 2 and 3.
[2] No sample.

TABLE 10.—*Effect of gin and lint cleaner combination and mill cleaning on length-distribution properties of finisher drawing sliver*

Test variable	Suter-Webb array					
	Upper-quartile length (in)	Mean length (in)	Coefficient of variability (%)	Fibers less than ½ in (%)	Fibers ½ to 1 in (%)	Fibers greater than 1 in (%)
Gin and lint cleaner combination:						
Saw gin and 2 saw lint cleaners	1.34	[1]1.13a	[1]25.00a	4	[2]24.2a	[2]72.0a
Saw gin and 1 saw lint cleaner	1.34	1.14ab	24.50ab	3	21.5ab	74.8ab
Roller gin and 2 mill lint cleaners	1.34	1.15b	23.25bc	4	18.8bc	77.6b
Roller gin and 1 saw lint cleaner	1.34	1.16b	23.00c	3	17.8c	78.7b
Mill-cleaning level:[1 3]						
Maximum	1.34	1.14	24.00	4a	20.7	75.4
Minimum	1.34	1.15	24.00	3b	20.4	76.1
Average	1.34	1.15	24.00	3	20.5	75.8

[1] Means not followed by a common letter differ at a 5% level of significance.
[2] Means not followed by a common letter differ at a 1% level of significance.
[3] For explanation of maximum and minimum, see table 5, notes 2 and 3.

TABLE 11.—*Effect of gin and lint cleaner combination and mill cleaning on selected yarn properties*

Test variable	Ends down per 1,000 spindle-hours	Break factor skein	Yarn appearance index	Single-strand data (Uster)	
				Strength (g)	Elongation (%)
Gin and lint cleaner combination:					
Saw gin and 2 saw lint cleaners	25	[1]2,141b	[2]111ab	140	5.2
Saw gin and 1 saw lint cleaner	21	2,174ab	105b	141	5.3
Roller gin and 2 mill lint cleaners	21	2,253a	115a	145	5.3
Roller gin and 1 saw lint cleaner	19	2,206ab	117a	143	5.3
Mill-cleaning level:[3]					
Maximum	21	2,205	111	142	5.3
Minimum	22	2,182	113	143	5.3
Average	21	2,194	112	142	5.3

[1] Means not followed by a common letter differ at a 1% level of significance.
[2] Means not followed by a common letter differ at a 5% level of significance.
[3] For explanation of maximum and minimum, see table 5, notes 2 and 3.

TABLE 12.—*Effect of gin and lint cleaner combination and mill cleaning on single-strand data*

Test variable	Strength coefficient of variability (%)	Single-strand data (Uster)			
		Neps per 1,000 yd	Thick places per 1,000 yd	Low places per 1,000 yd	Irregularity coefficient of variability (%)
Gin and lint cleaner combination:					
Saw gin and 2 saw lint cleaners	11.0	211	1,175	2,891	17.9
Saw gin and 1 saw lint cleaner	10.9	175	1,145	3,019	18.1
Roller gin and 2 mill lint cleaners	10.6	208	1,051	2,777	17.8
Roller gin and 1 saw lint cleaner	10.3	174	1,077	2,841	17.9
Mill-cleaning level:[1]					
Maximum	10.8	198	1,111	2,879	17.9
Minimum	10.6	186	1,112	2,885	17.9
Average	10.7	192	1,112	2,882	17.9

[1] For explanation of maximum and minimum, see table 5, notes 2 and 3.

picker waste, showed higher correlations with dust levels determined by the personal sampler than with levels determined by the elutriator sampler. Results show that dust levels, as expected, trended lower as leaf and composite grade and picker waste increased, and as total waste in ginned lint and card waste decreased.

Finisher Drawing Sliver Quality

Length and strength properties of the finisher drawing sliver, determined by digital fibrograph and Pressley strength tester, were not affected by gin and lint cleaner combination or mill cleaning (table 9). Significant differences noted in these properties in the ginned lint were eliminated in subsequent mill-processing operations.

Length and length-distribution properties of the finisher drawing sliver, determined by the array method, indicated differences in mean length, coefficient of variability, fibers one-half inch to 1 inch, and fibers greater than 1 inch attributable to gin and lint cleaner treatment (table 10).

Generally, roller-ginned cottons had a longer mean length and a larger percentage of fibers over 1 inch than the saw-ginned cottons.

Mill cleaning affected only the percentage of fibers less than one-half inch, there being a smaller percentage less than one-half inch for cottons with minimum mill cleaning.

Results of spinning tests showed that the break factor for the roller gin and two mill lint cleaner treatment was significantly higher than that of the saw gin and two saw type lint cleaner treatment, and that yarn appearance for both roller-ginned treatments was higher than that of the saw gin and one saw lint cleaner treatment (table 11). Ends down per 1,000 spindle-hours was not affected by gin and lint cleaner combination but trended higher for the saw gin and two saw lint cleaner treatment.

Ends down, break factor, and yarn appearance were not affected by mill-cleaning level.

Neither gin and lint cleaner combination nor mill-cleaning level affected results of single-strand tests (tables 11 and 12). Generally, neps per 1,000 yards trended lower for the treatments using one saw-type lint cleaner, and thick places and low places per 1,000 yards trended lower for the roller-ginned treatments.

SUMMARY

Machine-picked 'Acala 1517–V' cotton was processed through four gin and lint cleaner combinations and two mill-cleaning systems to determine the effect of such treatments on card-room dust levels and on fiber and yarn quality.

The type of gin and the type and number of lint cleaners used in combination with the gin affect card-room dust levels. Saw-ginned cotton produced less dust than roller-ginned cotton, and cotton processed through two saw-type lint cleaners produced less dust than cotton processed through one saw-type lint cleaner. High-

est card-room dust levels were produced by the roller gin and one saw-type lint cleaner combination.

Increasing the level of mill cleaning reduces card-room dust levels. Cotton processed through a vertical opener and a No. 12 lattice opener produced less dust than cotton that bypassed the two cleaners.

Significant differences in dust levels can be obtained by processing options currently available to the ginner and to the mill processor. It is doubtful, however, that those treatment combinations producing lowest dust levels encountered in this test would reduce dust levels sufficiently to preclude the use of control devices in the textile mill to assure compliance with OSHA standards.

Quality of the finisher drawing sliver and yarn was affected only moderately by the gin and lint cleaner combination and hardly at all by the mill-cleaning level. Generally, the finisher drawing sliver of the roller-ginned cotton had a longer mean length and a larger percentage of fibers greater than 1 inch than the saw-ginned cottons. Break factor and yarn appearance of roller-ginned cottons were higher than those of the saw-ginned cotton.

TRADE NAMES ARE USED IN THIS PUBLICATION SOLELY FOR THE PURPOSE OF PROVIDING SPECIFIC INFORMATION. MENTION OF A TRADE NAME DOES NOT CONSTITUTE A GUARANTEE OR WARRANTY OF THE PRODUCT BY THE U.S. DEPARTMENT OF AGRICULTURE OR AN ENDORSEMENT BY THE DEPARTMENT OVER OTHER PRODUCTS NOT MENTIONED.

U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
HYATTSVILLE, MARYLAND 20782

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.MAIL